SMART GLASS

Private and Cool

Glass partitions us from other people and the elements, while letting light through. But that transmission can be a problem if we want to have privacy or to block the sun's heat. Smart glass can help, letting us change the properties of windows on demand.

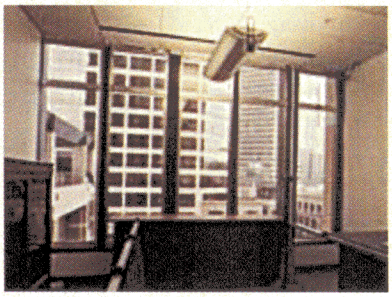
At the push of a button, liquid-crystal glass can rapidly transform from clear to frosted, turning a see-through conference room wall, shower stall or ambulance rear window into a visual barrier [*see illustration, top far right*]. No space-consuming or dirt-collecting shades, curtains or blinds are needed. This "privacy glass" is impossible to see through because it scatters incoming rays, yet the diffusion fills the interior space with natural light.

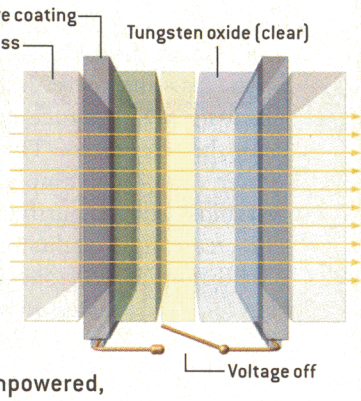
With electrochromic glass, applying a voltage for several seconds to several minutes darkens panels, blocking light [*see illustration, top right*]. When used as windows for buildings, they shade interiors and cut cooling costs. Inhabitants can control the degree of tint, which remains after the power is turned off.

Another option is glass containing suspended particles, which function somewhat the way liquid crystals do. Windows with thermochromic gels that turn white or colored when solar heat surpasses a threshold temperature can cut interior cooling demand, too.

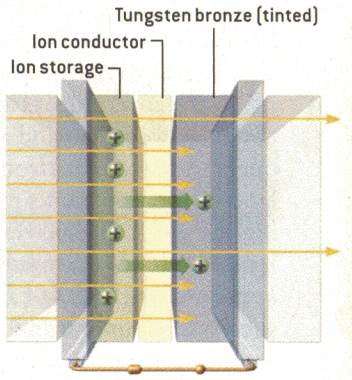
Privacy glass is not more ubiquitous because of the expense, which can be $100 to $130 a square foot versus $10 for standard tempered glass. But customers are becoming more intrigued: "They're using it not just for conference room and bathroom walls but in skylights that block UV [ultraviolet] rays, for privacy between restaurant booths, in bank offices, even for airplane windows," notes Jeff Besse, president of LTI Smart Glass in Lenox, Mass.

The price of electrochromics for energy-efficient buildings may be double that for "low-emissivity" gas-insulated glass, but the larger issue is convincing architects and builders about long-term durability, says Roland Pitts, optoelectronics team leader at the National Renewable Energy Laboratory in Golden, Colo. "The windows must be stable for 30 to 40 years under wide-ranging temperature and solar radiation conditions," he notes, "while switching on and off tens of thousands of times or more." —*Mark Fischetti*

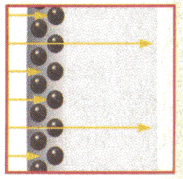




ELECTROCHROMIC WINDOW, when unpowered, transmits light; all layers are transparent.



APPLYING VOLTAGE creates an electric field that drives lithium ions from storage, converting tungsten oxide into tungsten bronze. That layer absorbs ultraviolet and certain visible wavelengths, resulting in a tint. The longer voltage is applied, the darker the tint. Tint remains for long periods after the power is turned off; applying a reverse voltage clears the glass. In an alternative solid-state design, the active inner layers constitute a thin film applied to one pane of glass.



PHOTOCHROMIC LENS is doped with silver halides. The molecules become excited when hit by the sun's ultraviolet rays and then absorb visible wavelengths, cutting glare and darkening the glass. Without UV rays indoors, the lenses lighten.

LAWRENCE BERKELEY NATIONAL LABORATORY (*top and middle left*); SMARTGLASS IRELAND LTD. (*top and middle right*); ILLUSTRATIONS BY GEORGE RETSECK